CLAIMS

1. A viewfinder optical system, comprising:

an objective lens unit;

an image inverting unit for converting an object image formed via said objective lens unit into a non-inverted erecting image; and

an eyepiece lens unit for observing the non-inverted erecting image,

wherein said image inverting unit comprises a first transparent body and a second transparent body which are disposed with an interval put therebetween, said second transparent body having only a function of transmitting a ray of light, and

wherein the interval between said first transparent body and said second transparent body is not uniform.

2. A viewfinder optical system according to claim 1, wherein at least one of a surface of said first transparent body and a surface of said second transparent body which are opposite to each other is a rotationally-asymmetrical surface.

3. A viewfinder optical system according to claim 2, wherein said first transparent body has a surface having only a function of reflecting a ray of light, and a surface having both a function of reflecting a ray of

light and a function of transmitting a ray of light.

4. A viewfinder optical system according to claim 3, wherein said second transparent body has a second entrance surface for transmitting a light flux coming from said objective lens unit, and a transmission surface disposed at an acute angle with the second entrance surface,

wherein said first transparent body consists of a first entrance surface disposed with the interval put between the transmission surface and the first entrance surface and arranged to allow a light flux coming from the transmission surface to enter the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the first entrance surface toward the first entrance surface, a total-reflection surface provided at a part of the first entrance surface and arranged to totally reflect a light flux coming from the reflecting surface, and an exit surface arranged to allow a light flux coming from the total-reflection surface to exit, and

wherein said image inverting unit further comprises a reflecting member arranged to reflect a light flux coming from the exit surface toward said eyepiece lens unit.

5. A viewfinder optical system according to claim 4, wherein the transmission surface is a rotationally-

asymmetrical surface.

6. A viewfinder optical system according to claim 3, wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from said objective lens unit,

wherein said second transparent body has a second entrance surface for transmitting a light flux coming from said reflecting member and a transmission surface disposed at an acute angle with the second entrance surface, and

wherein said first transparent body consists of a first entrance surface disposed with the interval put between the transmission surface and the first entrance surface and arranged to allow a light flux coming from the transmission surface to enter the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the first entrance surface toward the first entrance surface, a total-reflection surface provided at a part of the first entrance surface and arranged to totally reflect a light flux coming from the reflecting surface, and an exit surface arranged to allow a light flux coming from the total-reflection surface to exit.

7. A viewfinder optical system according to claim 6, wherein the transmission surface is a rotationally-asymmetrical surface.

8. A viewfinder optical system according to claim 3, wherein said first transparent body consists of a first entrance surface for transmitting a light flux coming from said objective lens unit, a total-reflection surface arranged to totally reflect a light flux coming from the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the total-reflection surface toward the total-reflection surface, and an exit surface provided at a part of the total-reflection surface and arranged to allow a light flux coming from the reflecting surface to exit,

wherein said second transparent body has a second entrance surface disposed with the interval put between the exit surface and the second entrance surface and arranged to allow a light flux coming from the exit surface to enter the second entrance surface, and a transmission surface disposed at an acute angle with the second entrance surface and arranged to allow a light flux coming from the second entrance surface to exit, and

wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from the transmission surface to lead the reflected light flux to said eyepiece lens unit.

9. A viewfinder optical system according to claim 8, wherein the second entrance surface is a rotationally-asymmetrical surface.

10. A viewfinder optical system according to claim 3, wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from said objective lens unit,

wherein said first transparent body consists of a first entrance surface for transmitting a light flux coming from said reflecting member, a total-reflection surface arranged to totally reflect a light flux coming from the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the total-reflection surface toward the total-reflection surface, and an exit surface provided at a part of the total-reflection surface and arranged to allow a light flux coming from the reflecting surface to exit, and

wherein said second transparent body has a second entrance surface disposed with the interval put between the exit surface and the second entrance surface and arranged to allow a light flux coming from the exit surface to enter the second entrance surface, and a transmission surface disposed at an acute angle with the second entrance surface and arranged to allow a light flux coming from the second entrance surface to exit to said eyepiece lens unit.

11. A viewfinder optical system according to claim 10, wherein the second entrance surface is a rotationally-asymmetrical surface.

12. A viewfinder optical system according to claim 3, wherein the rotationally-asymmetrical surface is a surface symmetrical with respect to a given direction.

13. A viewfinder optical system according to claim 12, wherein, when Cartesian coordinates using X, Y and Z axes are adopted, the rotationally-asymmetrical surface is a cylindrical surface having a predetermined curvature in a plane perpendicular to the X axis and having no curvature with respect to a direction of the X axis.

14. A viewfinder optical system according to claim 12, wherein, when Cartesian coordinates using X, Y and Z axes are adopted, the rotationally-asymmetrical surface is a toric surface in which a curvature in a plane perpendicular to the X axis differs from a curvature in a plane perpendicular to the Y axis.

15. A viewfinder optical system according to claim 3, wherein, when Cartesian coordinates using X, Y and Z axes are adopted, the rotationally-asymmetrical surface is a surface having two curvatures in a plane perpendicular to the X axis and having no curvature with respect to a direction of the X axis.

16. A viewfinder optical system according to claim 3, wherein the rotationally-asymmetrical surface has no axis of rotational symmetry.

17. A viewfinder optical system according to claim 3, wherein said first transparent body has a roof surface.

18. A viewfinder optical system according to claim 3, wherein said image inverting unit further comprises a reflecting member arranged to reflect a ray of light differently from said first transparent body and said second transparent body, and said reflecting member has a roof surface.

19. A viewfinder optical system according to claim 3, wherein said image inverting unit further comprises a reflecting member arranged to reflect a ray of light differently from said first transparent body and said second transparent body, and said reflecting member is made from a transparent body.

20. A viewfinder optical system according to claim 1, wherein the interval between a surface of said first transparent body and a surface of said second transparent body which are opposite to each other varies monotonically.

21. A viewfinder optical system according to claim 20, wherein each of the surface of said first transparent body and the surface of said second transparent body which are opposite to each other is a plane surface.

22. A viewfinder optical system according to claim 21, wherein said first transparent body has a surface having only a function of reflecting a ray of light, and a surface having both a function of reflecting a ray of light and a function of transmitting a ray of light.

23. A viewfinder optical system according to claim 22, wherein said second transparent body has a second entrance surface for transmitting a light flux coming from said objective lens unit, and a transmission surface disposed at an acute angle with the second entrance surface,

wherein said first transparent body consists of a first entrance surface disposed with the interval put between the transmission surface and the first entrance surface and arranged to allow a light flux coming from the transmission surface to enter the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the first entrance surface toward the first entrance surface, a total-reflection surface provided at a part of the first entrance surface and arranged to totally reflect a light flux coming from the reflecting surface, and an exit surface arranged to allow a light flux coming from the total-reflection surface to exit, and

wherein said image inverting unit further comprises a reflecting member arranged to reflect a light flux coming from the exit surface toward said eyepiece

lens unit.

24. A viewfinder optical system according to claim 23, wherein the transmission surface is a rotationally-asymmetrical surface.

25. A viewfinder optical system according to claim 22, wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from said objective lens unit,

wherein said second transparent body has a second entrance surface for transmitting a light flux coming from said reflecting member and a transmission surface disposed at an acute angle with the second entrance surface, and

wherein said first transparent body consists of a first entrance surface disposed with the interval put between the transmission surface and the first entrance surface and arranged to allow a light flux coming from the transmission surface to enter the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the first entrance surface toward the first entrance surface, a total-reflection surface provided at a part of the first entrance surface and arranged to totally reflect a light flux coming from the reflecting surface, and an exit surface arranged to allow a light flux coming from the total-reflection surface to exit.

26. A viewfinder optical system according to claim 25, wherein the transmission surface is a rotationally-asymmetrical surface.

27. A viewfinder optical system according to claim 22, wherein said first transparent body consists of a first entrance surface for transmitting a light flux coming from said objective lens unit, a total-reflection surface arranged to totally reflect a light flux coming from the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the total-reflection surface toward the total-reflection surface, and an exit surface provided at a part of the total-reflection surface and arranged to allow a light flux coming from the reflecting surface to exit,

wherein said second transparent body has a second entrance surface disposed with the interval put between the exit surface and the second entrance surface and arranged to allow a light flux coming from the exit surface to enter the second entrance surface, and a transmission surface disposed at an acute angle with the second entrance surface and arranged to allow a light flux coming from the second entrance surface to exit, and

wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from the transmission surface to lead the reflected light flux to said eyepiece lens unit.

28. A viewfinder optical system according to claim 27, wherein the second entrance surface is a rotationally-asymmetrical surface.

29. A viewfinder optical system according to claim 22, wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from said objective lens unit,

wherein said first transparent body consists of a first entrance surface for transmitting a light flux coming from said reflecting member, a total-reflection surface arranged to totally reflect a light flux coming from the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the total-reflection surface toward the total-reflection surface, and an exit surface provided at a part of the total-reflection surface and arranged to allow a light flux coming from the reflecting surface to exit, and

wherein said second transparent body has a second entrance surface disposed with the interval put between the exit surface and the second entrance surface and arranged to allow a light flux coming from the exit surface to enter the second entrance surface, and a transmission surface disposed at an acute angle with the second entrance surface and arranged to allow a light flux coming from the second entrance surface to exit to said eyepiece lens unit.

30. A viewfinder optical system according to claim 29, wherein the second entrance surface is a rotationally-asymmetrical surface.

31. A viewfinder optical system according to claim 22, wherein said first transparent body has a roof surface.

32. A viewfinder optical system according to claim 22, wherein said image inverting unit further comprises a reflecting member arranged to reflect a ray of light differently from said first transparent body and said second transparent body, and said reflecting member has a roof surface.

33. A viewfinder optical system according to claim 22, wherein said image inverting unit further comprises a reflecting member arranged to reflect a ray of light differently from said first transparent body and said second transparent body, and said reflecting member is made from a transparent body.

34. A viewfinder optical system according to claim 21, wherein the surface of said first transparent body and the surface of said second transparent body which are opposite to each other are in contact with each other at a portion outside a ray-effective aperture.

35. A viewfinder optical system according to claim 21, wherein the interval between the surface of said first transparent body and the surface of said second transparent body which are opposite to each other is set narrower toward a portion on a side of the larger one of angles which a ray of light incident on the interval makes with the interval.

36. A viewfinder optical system according to claim 21, wherein one of the surface of said first transparent body and the surface of said second transparent body which are opposite to each other is provided with, outside a ray-effective aperture, a protrusion or a spacer member for setting the interval.

37. A viewfinder optical system according to claim 21, wherein, when the interval between vertexes of the surface of said first transparent body and the surface of said second transparent body is denoted by Dg, the following condition is satisfied:

$$0 < Dg \leq 0.1 \text{ mm}.$$

38. A viewfinder optical system according to claim 21, wherein, when an angle which the surface of said first transparent body and the surface of said second transparent body, constituting the interval, make with each other is denoted by θg, the following condition is satisfied with 1' being (1/60)°:

$0' < \theta g \leq 50'$.

39. A viewfinder optical system, comprising:

an objective lens unit;

an image inverting unit for converting an object image formed via said objective lens unit into a non-inverted erecting image; and

an eyepiece lens unit for observing the non-inverted erecting image,

wherein said image inverting unit comprises a first transparent body and a second transparent body which are disposed with an interval put therebetween, said second transparent body having only a function of transmitting a ray of light, and

wherein at least one of surfaces of said first transparent body and said second transparent body is a rotationally-asymmetrical surface.

40. A viewfinder optical system according to claim 39, wherein said first transparent body has a surface having only a function of reflecting a ray of light, and a surface having both a function of reflecting a ray of light and a function of transmitting a ray of light.

41. A viewfinder optical system according to claim 40, wherein said second transparent body has a second entrance surface for transmitting a light flux coming from said objective lens unit, and a transmission surface

disposed at an acute angle with the second entrance surface,

wherein said first transparent body consists of a first entrance surface disposed with the interval put between the transmission surface and the first entrance surface and arranged to allow a light flux coming from the transmission surface to enter the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the first entrance surface toward the first entrance surface, a total-reflection surface provided at a part of the first entrance surface and arranged to totally reflect a light flux coming from the reflecting surface, and an exit surface arranged to allow a light flux coming from the total-reflection surface to exit, and

wherein said image inverting unit further comprises a reflecting member arranged to reflect a light flux coming from the exit surface toward said eyepiece lens unit.

42 A viewfinder optical system according to claim 41, wherein the transmission surface is a rotationally-asymmetrical surface.

43. A viewfinder optical system according to claim 40, wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from said objective lens unit,

wherein said second transparent body has a second entrance surface for transmitting a light flux coming from said reflecting member and a transmission surface disposed at an acute angle with the second entrance surface, and

wherein said first transparent body consists of a first entrance surface disposed with the interval put between the transmission surface and the first entrance surface and arranged to allow a light flux coming from the transmission surface to enter the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the first entrance surface toward the first entrance surface, a total-reflection surface provided at a part of the first entrance surface and arranged to totally reflect a light flux coming from the reflecting surface, and an exit surface arranged to allow a light flux coming from the total-reflection surface to exit.

44. A viewfinder optical system according to claim 43, wherein the transmission surface is a rotationally-asymmetrical surface.

45. A viewfinder optical system according to claim 40, wherein said first transparent body consists of a first entrance surface for transmitting a light flux coming from said objective lens unit, a total-reflection surface arranged to totally reflect a light flux coming

from the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the total-reflection surface toward the total-reflection surface, and an exit surface provided at a part of the total-reflection surface and arranged to allow a light flux coming from the reflecting surface to exit,

wherein said second transparent body has a second entrance surface disposed with the interval put between the exit surface and the second entrance surface and arranged to allow a light flux coming from the exit surface to enter the second entrance surface, and a transmission surface disposed at an acute angle with the second entrance surface and arranged to allow a light flux coming from the second entrance surface to exit, and

wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from the transmission surface to lead the reflected light flux to said eyepiece lens unit.

46. A viewfinder optical system according to claim 45, wherein the second entrance surface is a rotationally-asymmetrical surface.

47. A viewfinder optical system according to claim 40, wherein said image inverting unit further comprises a reflecting member arranged to reflect, at least once, a light flux coming from the objective lens unit,

wherein said first transparent body consists of a first entrance surface for transmitting a light flux coming from said reflecting member, a total-reflection surface arranged to totally reflect a light flux coming from the first entrance surface, a reflecting surface arranged to reflect a light flux coming from the total-reflection surface toward the total-reflection surface, and an exit surface provided at a part of the total-reflection surface and arranged to allow a light flux coming from the reflecting surface to exit, and

wherein said second transparent body has a second entrance surface disposed with the interval put between the exit surface and the second entrance surface and arranged to allow a light flux coming from the exit surface to enter the second entrance surface, and a transmission surface disposed at an acute angle with the second entrance surface and arranged to allow a light flux coming from the second entrance surface to exit to said eyepiece lens unit.

48. A viewfinder optical system according to claim 47, wherein the second entrance surface is a rotationally-asymmetrical surface.

49. A viewfinder optical system according to claim 40, wherein the rotationally-asymmetrical surface is a surface symmetrical with respect to a given direction.

50. A viewfinder optical system according to claim 49, wherein, when Cartesian coordinates using X, Y and Z axes are adopted, the rotationally-asymmetrical surface is a cylindrical surface having a predetermined curvature in a plane perpendicular to the X axis and having no curvature with respect to a direction of the X axis.

51. A viewfinder optical system according to claim 49, wherein, when Cartesian coordinates using X, Y and Z axes are adopted, the rotationally-asymmetrical surface is a toric surface in which a curvature in a plane perpendicular to the X axis differs from a curvature in a plane perpendicular to the Y axis.

52. A viewfinder optical system according to claim 40, wherein, when Cartesian coordinates using X, Y and Z axes are adopted, the rotationally-asymmetrical surface is a surface having two curvatures in a plane perpendicular to the X axis and having no curvature with respect to a direction of the X axis.

53. A viewfinder optical system according to claim 40, wherein the rotationally-asymmetrical surface has no axis of rotational symmetry.

54. A viewfinder optical system according to claim 40, wherein said first transparent body has a roof surface.

55. A viewfinder optical system according to claim 40, wherein said image inverting unit further comprises a reflecting member arranged to reflect a ray of light differently from said first transparent body and said second transparent body, and said reflecting member has a roof surface.

56. A viewfinder optical system according to claim 40, wherein said image inverting unit further comprises a reflecting member arranged to reflect a ray of light differently from said first transparent body and said second transparent body, and said reflecting member is made from a transparent body.

57. An optical apparatus, comprising:

a viewfinder optical system according to claim 1; and

a casing holding said viewfinder optical system.

58. An optical apparatus according to claim 57, wherein at least one of a surface of said first transparent body and a surface of said second transparent body which are opposite to each other is a rotationally-asymmetrical surface.

59. An optical apparatus according to claim 58, wherein said first transparent body has a surface having only a function of reflecting a ray of light, and a

surface having both a function of reflecting a ray of light and a function of transmitting a ray of light.

60. An optical apparatus according to claim 57, wherein the interval between a surface of said first transparent body and a surface of said second transparent body which are opposite to each other varies monotonically.

61. An optical apparatus according to claim 60, wherein each of the surface of said first transparent body and the surface of said second transparent body which are opposite to each other is a plane surface.

62. An optical apparatus according to claim 61, wherein said first transparent body has a surface having only a function of reflecting a ray of light, and a surface having both a function of reflecting a ray of light and a function of transmitting a ray of light.

63. An optical apparatus, comprising:

a viewfinder optical system according to claim 39; and

a casing holding said viewfinder optical system.

64. An optical apparatus according to claim 63, wherein said first transparent body has a surface having only a function of reflecting a ray of light, and a

surface having both a function of reflecting a ray of light and a function of transmitting a ray of light.